Ancient and modern: digital reconstruction of the Classical past

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Imagining what ancient Rome and other ancient sites really looked like has led people to create drawings, plaster models, and even reconstruct the buildings themselves, but now digital reconstruction on computers offers a new way of viewing ancient Rome.

For as long as people have been interested in the ruins of the Classical civilisations they have been trying to imagine their original appearance, piecing together the fragments that survive. Drawings and paintings of Rome in particular date back from as early as the medieval period, ranging from the scholarly to the wildly imaginative.

From paper to plaster: two- and three-dimensional Romes

When archaeologists began to investigate and interpret the remains in the 18th and 19th centuries, they too used reconstructive drawings and prints to explain their ideas. Reconstructions have continued to be made ever since and are still the principal visual tool for interpreting and displaying knowledge of ancient sites. The best of these are excellent tools for researchers, students, and tourists alike, but even the best two-dimensional views are limited in what they can show; their fixed point of view means that they are very good at showing some elements of a site's layout and detail, but not others. A plan view, for example, can show how buildings relate to each other in two dimensions but are less clear for the third (usually height), while a perspective drawing solves that problem at the expense of a constant scale.

One solution is the production of three-dimensional models. Grand tourists to Italy could buy lovely cork or plaster models as high-class souvenirs as early as the late 18th century, and as archaeology developed as a discipline throughout the following decades the value of these models for students was soon realised.

The most ambitious physical model ever attempted was Gismondi's magnificent plaster model of the entire city of Rome in the era of Constantine. It took decades to make and is still on display in the EUR Museum in Rome. Visitors who look down on it from viewing galleries get a marvellous impression of tightly packed streets and clustering high-rise blocks, and see how the major monuments relate to each other and to the geography of the city – but this medium also has its limitations too. The huge size and fragility of the model mean that it is impossible to get down close to it to look at ancient Rome from 'street level'; even if a visitor could descend from the gallery to look at the model close up, the level of detail at the scale of the individual building is not particularly high, and a lack of documentation means there is no way of checking the reasons behind any of the thousands of choices Gismondi had to make as he filled in the blanks on his huge map.

Re-building the past – physical reconstruction

Physical restoration of archaeological sites is another way of presenting a version of their original appearance. Recent visitors to the Acropolis in Athens, for example, will have noticed gleaming new blocks of stone being cut to fill gaps in the ancient structure, while in Rome a set of rather fake-looking columns has recently appeared at the Temple of Venus and Rome (to celebrate the fashion designer Valentino, oddly enough). This method can certainly bring a ruined structure back to something like its original appearance, but it is only visible to visitors to the sites themselves, is expensive, and can be controversial. Intervention in the physical fabric of an ancient structure changes what archaeologists usually seek to preserve; at best it creates a convincing appearance, but at worst it can mislead visitors or even damage the ancient remains – there are plenty of sites where protective or reconstructive materials are now flaking and rusting after only a few years.

Monitoring Rome – computerized digital reconstruction

Digital reconstruction offers an alternative, balancing out some of the shortcomings of these older techniques. By making a model of a building inside a computer, using measurements from existing remains and then artistic or archaeological imagination to fill in the gaps, it is possible to create a reconstruction that can be rotated and scaled to any position, added to other models, changed and adapted at will, and presented in different modes from static images to animations or even walk-through 'real time' graphics.

The effect is confined (at the moment) to a two-dimensional screen but is usually cheaper and easier than physical rebuilding or the creation of an equivalent number of paper drawings (a computer modeller's task is made much easier by the fact that Classical architecture relies heavily on the repetition of identical elements like columns – these can be drawn once and then easily multiplied by the computer as many times as they are needed). It also has the advantage of being more flexible when future alterations need to be made: when new discoveries or theories change our impression of a building then they can be incorporated into the computer model with a few mouse clicks.

The results can be vivid and exciting, producing convincing reconstruction scenes. For the British School at Rome's undergraduate summer school, for example, I have made my own model of the central part of the ancient city to illustrate lectures, and it seems to go down well with students. Digital reconstructions in three dimensions can be easier to grasp than archaeological or architectural plans, showing how buildings relate to one another and to the spaces around them, and providing a useful orientation for site visits or further reading.

Building in bricks and pixels

Digital reconstruction is now beginning to produce some very useful results (internet addresses are given below). An American research team, for example, has made a model of the Forum at

Rome which allows the viewer to access information about the buildings shown and the process by which they were created. In this country academics at the University of Warwick have achieved something similar for Pompey's Theatre, using computer modelling to combine various older plans of the structure.

This project in particular has shown how modelling a building can be useful to the archaeologists involved as well as to their eventual audience. Architects have known about the value of model-making for centuries, using it to identify potential problems between the paper design phase and the start of construction; archaeologists often find the same is true of their own models. Thinking how all the structural and decorative elements of a building fit together in three dimensions is a useful consequence of trying to rebuild it inside a computer.

Digital models can also be used to tackle questions unanswerable in other media. Computers can easily cast different sorts of virtual light onto buildings, for example, enabling us to view them at different times of year and in different weather conditions, and to work out how well illuminated they would have been. Virtual buildings can be easily cut away to reveal how different parts relate to each other (like the model of one of the emperor Trajan's libraries pictured here), while researchers on the Colosseum and ancient theatres have populated their models with virtual crowds, assessing the movement of people through the structures and how they might have interacted. With patience and imagination all sorts of different conditions can be tested out, adding to the research value of the digital models.

The limits of digital reconstruction

Digital modelling has many advantages, then, but like all the media that have been used in the past it has its shortcomings. It is equally dependent on the interpretation of the archaeologists who use it and therefore equally prone to error. The temptation to produce a convincing and attractive model might lead the reconstructor to go too far, running the risk of shaping evidence to fit a pre-existing view of how the building 'must' have looked – just like Piranesi's maps, or the very attractive 19th-century French watercolour reconstructions of Rome that often reflect contemporary tastes as much as the ancient remains. An extreme example of this is seen in some of the most dramatic computer reconstructions of all, those produced by Hollywood studios – but while these look impressive their goals are driven by the needs of the films they feature in, and they are rarely accurate in a scholarly sense.

The pros outweigh the cons, though, and it seems likely that digital reconstruction will become a more familiar part of our approach to the ancient world, especially as more people participate. Reconstruction software has become easier to learn and more affordable, or even free, in the last few years (see below for links) and the average computer can now run it smoothly. Sites like GoogleEarth are beginning to incorporate 3D buildings contributed by users, including many ancient structures. The future looks bright for digital modelling, and now is a good time to get involved.

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